



## Increasing the Energy Efficiency of Detached Houses

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**Abstract:** *The article analyzes ways to improve the energy efficiency of individual housing, taking into account the conditions of Uzbekistan.*

**Keywords:** *fuel, heat-insulating materials, heating systems, thermal energy, boilers, temperature regulators, walls, solar panels, alternative energy sources.*

### Introduction.

In the following years, aimed at ensuring energy saving, measures for the development of renewable energy in economic sectors and the social sphere, measures to increase energy efficiency in 2017-2021, approved by the decision of the President of the Republic of Uzbekistan No. PQ-3012 of May 26, 2017 works are being carried out within the framework of the program.

At the same time, despite the ongoing work, the energy capacity of the national economy remains high. remains high. Adaptation of brick and cement production plants, lime production enterprises and greenhouse farms to alternative fuel types is not sufficiently organized..

According to experts, relative costs of buildings are distributed as follows: through infiltration of hot air - 40%; -30% due to insufficient thermal resistance of barrier structures; non-rational use of hot water and inability to manage heating -30% (Fig. 1).

The following can be distinguished as reasons for irrational consumption of heat energy:

1. Incomplete functioning of natural ventilation systems;
2. Not closing windows and doors tightly;
3. Choosing the wrong architectural and construction solutions for heating the stair blocks;
4. Low-quality insulation of walls, basements, ceilings and various structures;
5. Lack of sufficient accounting and management equipment in heat and hot water supply systems;
6. A large number of external heat networks and their insufficient insulation;
7. Obsolescence and ineffectiveness of boiler devices;
8. Not using secondary energy sources;

Today, in our Republic, a strategy has been developed to save energy in the construction and use of buildings and structures. The main ones are the following:

1. Ensuring a logical sequence of energy-efficient ways of urban construction, architectural design, structural, engineering and operational works;
2. Achieving maximum saving of energy resources with minimum financial expenses;
3. To achieve energy saving efficiency of at least 90% through modernization and reconstruction of used buildings, structures and engineering communications;
4. Research of energy-saving standards in the design of buildings and structures.

Houses in the village have been repaired and updated as much as possible over the decades. Now heating costs will increase significantly. Is it possible to heat the house without increasing heating costs?

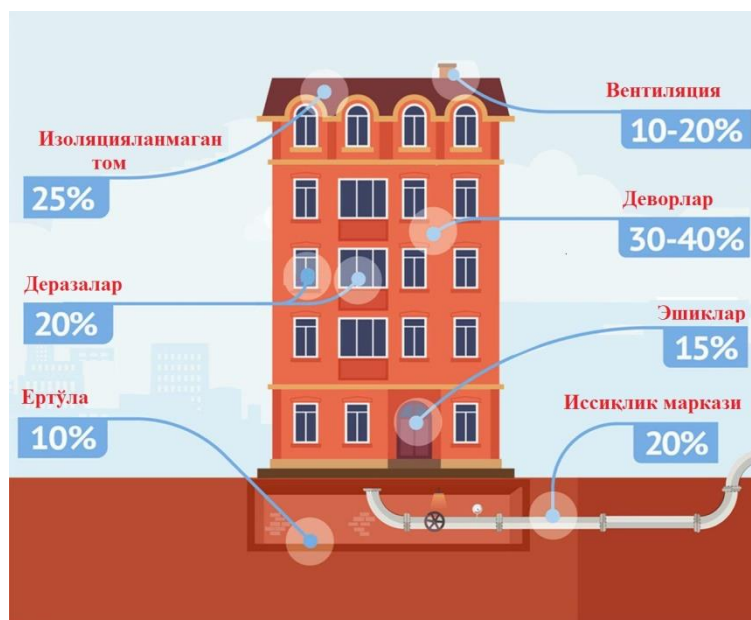
We started by identifying the causes of high heat consumption. In rural areas, the condition of individual houses usually changes to the same extent. Walls, windows and entrance doors - most of the heat energy used for heating goes through these structures.

In addition, such houses have outdated boilers, which leads to excessive losses of energy sources (gas, coal, firewood) and ultimately increases costs.

For these two reasons, 2-3 times more money is spent on heating in such detached houses than in modern buildings.

In order to get the most out of the funds spent on home renovations, it is necessary to first independently determine what needs to be replaced or repaired in the house.

Thermal modernization of a single-family house is carried out in three directions:



**Figure 1. Heat losses of the building.**

- insulating the covering parts of buildings (walls, foundations, windows, doors);
- modernization of heating and ventilation systems;
- use of renewable energy sources.

It is known that most heat is lost from the main part of the house: walls, ceilings, foundations, windows and doors.

Heat loss through the outer walls of most buildings ranges from 20% to 45%.

Due to the insulation of the external walls, these losses can be eliminated. Two main technologies are used for this: covering the walls with heat insulating materials and using heat insulating plasters. Mineral wool (glass wool, slag wool, stone or basalt wool) and polystyrene (polystyrene and extracted foam) thermal insulation materials are mainly used for wall covering. Covering materials are prepared in the form of plates and rolls of different thicknesses, and are fastened to the walls using special mounting glues and dowel nails. In order to protect the insulation from moisture, its surface is covered with insulating plaster. This layer acts as both a protective and a decorative layer.

Another way to protect the insulation is the "ventilation facade" method. The essence of this method is to leave an air layer between the insulating layer and the finishing layer made of ceramic tiles, thanks to which the moisture falling on the insulating layer evaporates quickly. Foamed materials (vermiculite or perlite) are used as heat insulating plaster. Such materials together with thermal protection of the walls have very high thermal performance. Such materials are mainly used for walls (brick, block) or monolithic (gravel-concrete, concrete, etc.) walls. The above methods will increase the energy efficiency of the wall.

Replacing old windows is the next step in building insulation. According to experts, heat loss through old glass is 15% to 25%. There are dozens of types of windows on the market today. They differ depending on the materials used: wood, wood-metal, metal, metal-plastic. Single-chamber and double-chamber, filled with special gas mixtures, transparent films and coatings are also used. Understandably, they differ in price. Today, every home owner can choose the type of window depending on their wishes and financial capabilities.

Modernization of ventilation systems helps to save energy during heating. Heat energy recovery is the process of heating air in hot air exchange devices. Therefore, most of the heat energy is returned to buildings.

Now let's see how to update the heating system of the house. The condition and efficiency of the heating system in a private house has a significant impact on reducing energy consumption. At one time, due to mass gasification of settlements, many homeowners tried to heat their houses using gas boilers. This was the most effective method when gas prices were low. Today, taking into account the ever-increasing price of gas, it is advisable to switch to alternative fuels for heating single-family houses.

House owners usually replace gas boilers with solid fuel boilers, the use of which allows to reduce heating costs by 1.5-2 times. Such boilers work on coal, pellets or wood. At the same time, modern solid fuel boilers are equipped with an automated combustion system. In some cases, replacing gas boilers with electric ones, as well as switching to a heating system using electric heating cables and mats - the use of the so-called "warm floor" methods is economically effective.

Thermoregulators (thermostat) are used in order to save fuel consumption in the boiler. Such thermoregulators are used for electric, gas and solid fuel boilers. Boilers equipped with a thermostat maintain the temperature in the room with an accuracy of 1-5 degrees. There are electromechanical and electronic types of thermostats. They are divided into wired and wireless (remote controlled) thermostats.

In wireless thermostats, the operation of the boiler is controlled using radio signals. There are two blocks of such a thermostat, the first of which is installed next to the boiler and connected using a clamp. The second block is installed in the room. Today, Siemens RAA21, RAA31 thermostats are widely used. The temperature in them is controlled in the range of 8-10 °C degrees. The price of such thermostats for gas

boilers is 190,000 soums. Remotely controlled thermostats have many functions. Modern thermoregulators are equipped with the JSM standard, and it is possible to control the operation of the boiler through a mobile phone. The price of thermoregulators for AURATON 2030 RTH gas boilers developed by BAXI is 800,000 soums. Thermoregulators developed by BAXI ARISTON, SALUS controls LTD, BOSH companies are widely used for electric boilers.

The price of thermoregulator for AURATON RTH brand boiler used on solid fuel is 871,000 soums.

In order to maintain a moderate temperature in the room, thermoregulators are installed on heating radiators. As a result, a comfortable atmosphere is created at home. At the same time, less money is spent on heating. Air temperature in rooms can be controlled by 2 methods - quality and quantity. In the first method, the temperature is controlled through a mixer installed in the boiler room. The amount of hot water entering the heating radiator is controlled quantitatively. So, the main task of the thermostat is to control the amount of hot water. When the ambient temperature rises, a special thermocouple is activated in the electronic device and partially covers the water passage surface. As a result, the passage of hot water through the radiators decreases and the radiator cools down. If the surrounding air temperature decreases, the above processes will reverse.

Today, the rapidly increasing amount of energy supply in modern large cities requires the development of alternative energy sources. In today's conditions, when hydrocarbon raw materials are decreasing, almost all countries of the world are looking for developments in the use of alternative energy sources, which are an important source of sustainable growth of the economy and increasing its competitiveness. Previously, alternative energy sources were considered expensive and economically inappropriate, but today the use of solar cells is no surprise. Alternative energy sources are actively introduced into the energy system of our country, effective research is being conducted in this regard, and various renewable energy sources are being developed.

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